

WHAT IS CLAIMED IS:

1. A pattern writing apparatus for writing a pattern by light irradiation on a photosensitive material, comprising:

a spatial light modulator applying a modulated light beam to an irradiation region

5 group arrayed in a lattice arrangement on a photosensitive material;

a main scanning mechanism for scanning said irradiation region group over a photosensitive material in a main scanning direction that is tilted relative to a direction of arrangement of said irradiation region group, so that a plurality of irradiation regions pass over each of writing regions included in a writing region group fixed on said photosensitive

10 material;

a sub-scanning mechanism for intermittently moving said irradiation region group relative to a photosensitive material in a sub-scanning direction orthogonal to said main scanning direction by a distance shorter than a width of said irradiation region group in said sub-scanning direction; and

15 a controller controlling said spatial light modulator in synchronization with main scanning of said irradiation region group.

2. The pattern writing apparatus according to claim 1, wherein

said spatial light modulator comprises an array of a plurality of micromirrors,

20 orientations of which are individually changed.

3. The pattern writing apparatus according to claim 1, wherein

said irradiation region group is a rectangular region in which irradiation regions are arrayed at equal pitches in two directions perpendicular to each other.

4. The pattern writing apparatus according to claim 3, wherein
a travel distance of said irradiation region group in said sub-scanning direction in
one intermittent movement is approximately equal to a width of one side of said rectangular
region in said sub-scanning direction, said one side extending approximately along said sub-
scanning direction.

5. The pattern writing apparatus according to claim 3, wherein
an equation, $A=B \times \cos \theta$ is satisfied,
where A is a travel distance of said irradiation region group in said sub-scanning
direction in one intermittent movement, B is a length of one side of said rectangular region,
said one side extending approximately along said sub-scanning direction, and θ is an angle
formed between said sub-scanning direction and a direction approximately along said sub-
scanning direction out of two directions of arrangement of said irradiation region group.

15 6. The pattern writing apparatus according to claim 3, further comprising
a data generator generating data inputted into said spatial light modulator,
wherein

said data generator performs the steps of:
extracting a strip-like writing region group, which corresponds to one main
20 scanning of said irradiation region group, from said writing region group;

shifting, in said main scanning direction, each array of writing regions arranged in
said main scanning direction in said strip-like writing region group so that writing regions
corresponding to one light irradiation on said irradiation region group are arranged in said
sub-scanning direction; and

25 generating a data set, which is inputted into said spatial light modulator for each

light irradiation, from pixel values each associated with each writing region in a writing region group after shifting.

7. The pattern writing apparatus according to claim 6, wherein

5 out of writing regions corresponding to one light irradiation in said strip-like writing region group, writing regions which are arranged in a direction approximately along said main scanning direction are arranged adjacent each other in said sub-scanning direction as a unit writing region group in said writing region group after shifting,

said step of generating a data set comprises the steps of:

10 at every spacing in said main scanning direction between writing regions located at centers of said irradiation region group in one light irradiation, extracting writing regions which are arranged in said sub-scanning direction from said writing region group after shifting, thereby to generate a plurality of partial writing region groups;

15 in each of said plurality of partial writing region groups, rearranging writing regions of each unit writing region group in said main scanning direction, thereby to generate an array of a plurality of pixel values; and

extracting a partial array from said array of a plurality of pixel values and converting said partial array into said data set.

20 8. The pattern writing apparatus according to claim 7, wherein

said step of converting said partial array into said data set is repeated in parallel with repetition of light irradiation on said irradiation region group.

9. The pattern writing apparatus according to claim 1, wherein

25 a pattern is written on a photoresist film on a substrate.

10. The pattern writing apparatus according to claim 1, wherein
said main scanning mechanism continuously moves said irradiation region group.

5 11. A pattern writing method of writing a pattern by light irradiation on a
photosensitive material, comprising the steps of:

10 applying a modulated light beam generated by a spatial light modulator to an
irradiation region group arrayed in a lattice arrangement on a photosensitive material with
scanning said irradiation region group over a photosensitive material in a main scanning
direction that is tilted relative to a direction of arrangement of said irradiation region group,
so that a plurality of irradiation regions pass over each of writing regions included in a
writing region group fixed on said photosensitive material;

15 controlling said spatial light modulator in synchronization with main scanning of
said irradiation region group; and

20 moving said irradiation region group relative to a photosensitive material in a sub-
scanning direction orthogonal to said main scanning direction by a distance shorter than a
width of said irradiation region group in said sub-scanning direction after scanning in said
main scaning direction, thereby to locate said irradiation region group at a start position for a
next main scan.

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12. The pattern writing method according to claim 11, wherein
said spatial light modulator comprises an array of a plurality of micromirrors,
orientations of which are individually changed.

25 13. The pattern writing method according to claim 11, wherein

said irradiation region group is a rectangular region in which irradiation regions are arrayed at equal pitches in two directions perpendicular to each other.

14. The pattern writing method according to claim 13, wherein
5 a travel distance of said irradiation region group in said sub-scanning direction in one intermittent movement is approximately equal to a width of one side of said rectangular region in said sub-scanning direction, said one side extending approximately along said sub-scanning direction.

10 15. The pattern writing method according to claim 13, wherein
an equation, $A=B \times \cos \theta$ is satisfied,
where A is a travel distance of said irradiation region group in said sub-scanning direction in one intermittent movement, B is a length of one side of said rectangular region, said one side extending approximately along said sub-scanning direction, and θ is an angle
15 formed between said sub-scanning direction and a direction approximately along said sub-scanning direction out of two directions of arrangement of said irradiation region group.

16. The pattern writing method according to claim 13, further comprising the steps
of:
20 extracting a strip-like writing region group, which corresponds to one main scanning of said irradiation region group, from said writing region group;
shifting, in said main scanning direction, each array of writing regions arranged in said main scanning direction in said strip-like writing region group so that writing regions corresponding to one light irradiation on said irradiation region group are arranged in said
25 sub-scanning direction; and

generating a data set, which is inputted into said spatial light modulator for each light irradiation, from pixel values each associated with each writing region in a writing region group after shifting.

5 17. The pattern writing method according to claim 16, wherein
 out of writing regions corresponding to one light irradiation in said strip-like writing region group, writing regions which are arranged in a direction approximately along said main scanning direction are arranged adjacent each other in said sub-scanning direction as a unit writing region group in said writing region group after shifting,

10 said step of generating a data set comprises the steps of:
 at every spacing in said main scanning direction between writing regions located at centers of said irradiation region group in one light irradiation, extracting writing regions which are arranged in said sub-scanning direction from said writing region group after shifting, thereby to generate a plurality of partial writing region groups;

15 in each of said plurality of partial writing region groups, rearranging writing regions of each unit writing region group in said main scanning direction, thereby to generate an array of a plurality of pixel values; and

 extracting a partial array from said array of a plurality of pixel values and converting said partial array into said data set.

20 18. The pattern writing method according to claim 17, wherein
 said step of converting said partial array into said data set is repeated in parallel with repetition of light irradiation on said irradiation region group.

25 19. The pattern writing method according to claim 11, wherein

a pattern is written on a photoresist film on a substrate.

**20. The pattern writing method according to claim 11, wherein
said irradiation region group continuously moves.**